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The Potential of CO_2 geological utilization and storage in the Junggar Basin

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RESEARCH PROJECT INTRODUCTION

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1. Research project introduction

- **China - Australia Geological Storage of CO_2 – CAGS3**

Finished by:

- *Center for Hydrogeology and Environmental Geology Survey, CGS*
- *Institute of Rock and Soil Mechanics, Chinese Academic of Sciences*

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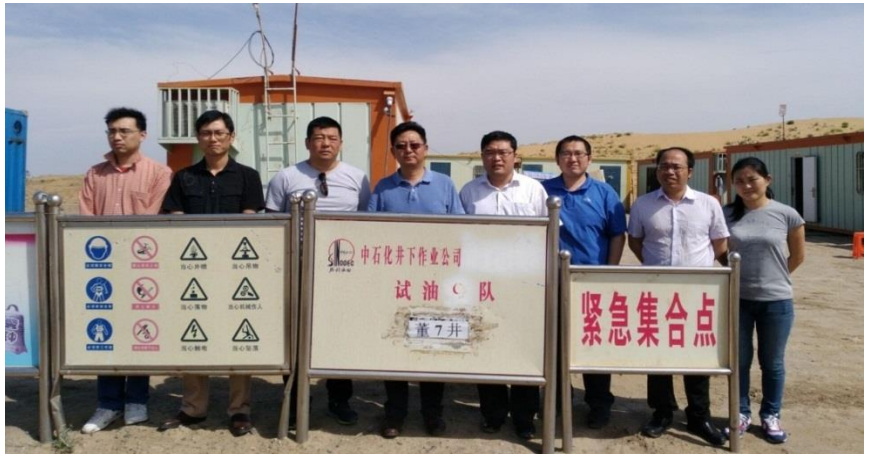
1. Research project introduction



Field visit in June, 2016

Project start-up workshop in July, 2016

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1. Research project introduction

CGS and AUGSs meetings during China Mining Congress in Sep., 2016 and Sep., 2017

1. Research project introduction

2D seismic exploration in 2016

Drilling and reservoir test in 2017

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CO_2 EMISSIONS IN THE JUNGGAR BASIN

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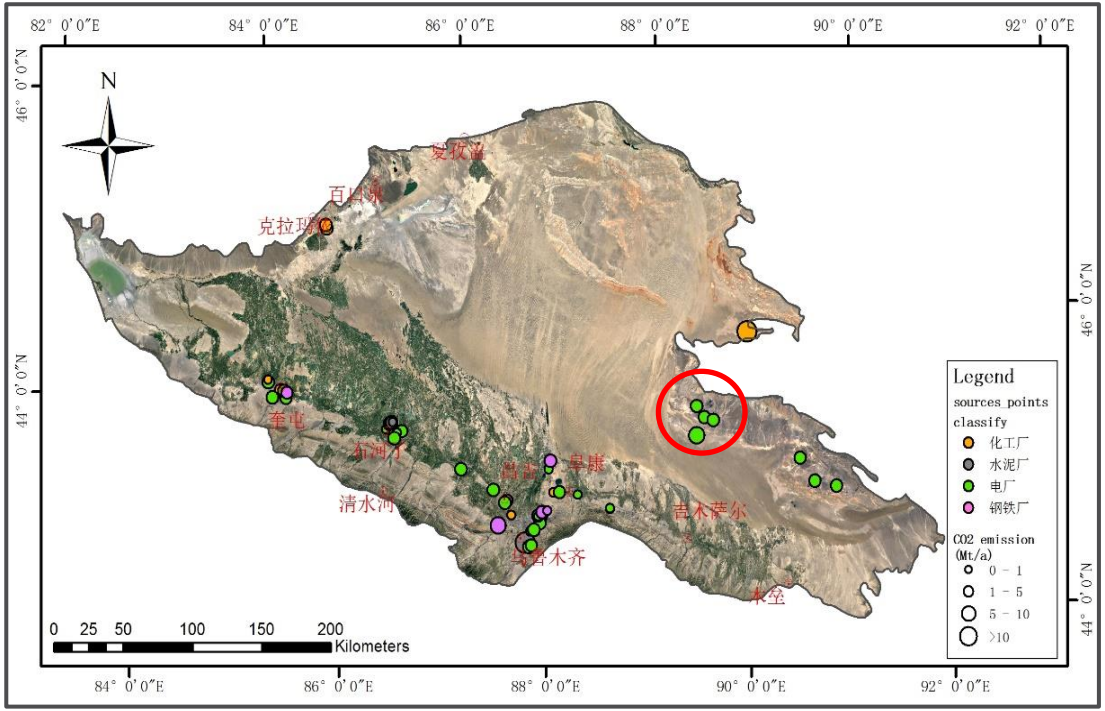
2. CO_2 emissions in the Junggar Basin



Methodology:

— 《IPCC Guidelines for National GHG Inventories (2016)》

Sources	Amount	Emission（Mt/a）
Power plant	32	67.51
Steel plant	5	14.53
Cement plant	5	28.05
Chemistry industry	12	22.13
Total	**54**	**132.22**

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MESOSCALE POTENTIAL OF CGUS IN THE JUNGGAR BASIN

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3. Mesoscale potential of CGUS in Junggar Basin

CO_2 geological utilization and storage, CGUS

CGUS	Purpose	Technologies
CO_2 Geological Utilization	Energy Production	Enhanced Oil Recovery, CO_2-EOR
		Enhanced Coal Bed Methane, CO_2-ECBM
		Enhanced Gas Recovery, CO_2-EGR
		Enhanced Shale Gas Recovery, CO_2-ESGR
	Resources production	Enhanced Geothermal Systems, CO_2-EGS
		Enhanced Uranium Leaching，CO_2-EUL
		Enhanced Water Recovery，CO_2-EWR
CO_2 Geological Storage	Saline Aquifers, Depleted Oil & Gas Fields, Unmineable Coal Seams	

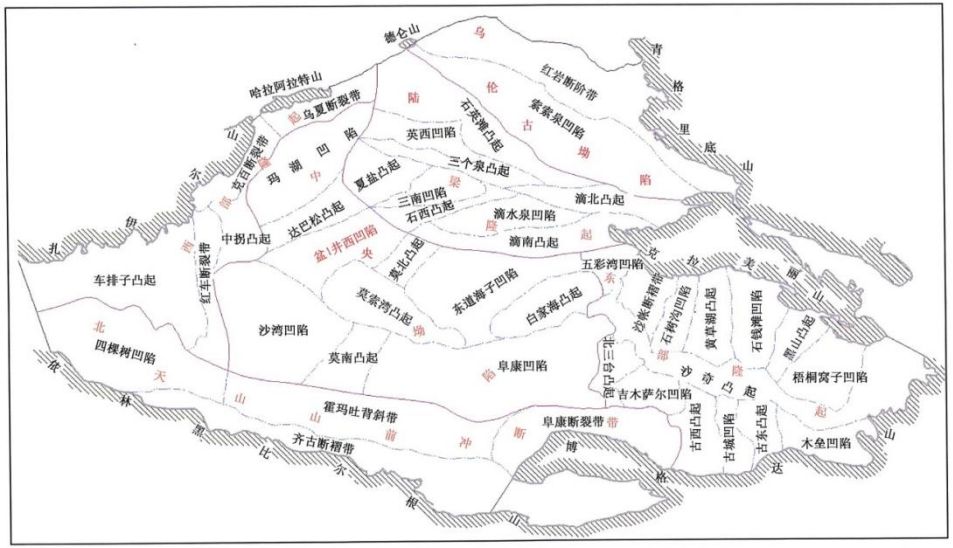
ACCA21, 2014

3. Mesoscale potential of CGUS in Junggar Basin

Reservoir selection for potential assessment

- Depth: 800 – 3500 m
- Lithology: clastic rocks, carbonate rocks
- Thickness: ≥ 10 m
- Porosity: ≥ 5%
- Permeability: ≥1 mD
- Caprocks: regional, generally mudstone and thicker than 20 m
- Distance from the nearby active faults: > 25 km
- Peak ground acceleration: < 0.40 g
- Hydrogeology: not open regional hydrodynamic areas

3. Mesoscale potential of CGUS in Junggar Basin



Geostructure

地层系统			厚度(m)	岩性剖面	储层	盖层	平均孔隙度(%)	平均渗透率($10^{-3}\mu m^2$)	储集空间	构造运动	盆地演化
系	组	地层代号									
Q	西域组	Q1x	2478							喜马拉雅运动	准南陆内前陆盆地阶段
N	独山子组	N2d									
	塔西河组	N1t	2800								
	沙湾组	N1s									
E	安集海河组	E3a	1180						砂岩孔隙型为主		陆内统一坳陷阶段
	紫泥泉子组	E1-2z					12.7	3.87-127			
K	东沟组	K2d	2000				22.25	110.38		燕山运动Ⅱ幕	
	连木沁组	K1l					>20	>50			
	胜金口组	K1s									
	呼图壁河组	K1h					>15	9.68-607.48			
	清水河组	K1q					16.29	1.47-369.82			
J	齐古组	J3q	3600				>10	3.62-161.99		燕山运动Ⅰ幕	压扭盆地阶段
	头屯河组	J2t					18.35				
	西山窑组	J2x					>10	1-225.04		晚印支运动	伸展盆地阶段
	三工河组	J1s					>10	1-375.36			
	八道湾组	J1b					>10	>5			
T	白碱滩组	T3b	1700				>10	>50		早印支运动	陆内坳陷阶段
	克拉玛依组	T2k									
	百口泉组	T1b					13.18	16.15-77.12			

23 reservoirs

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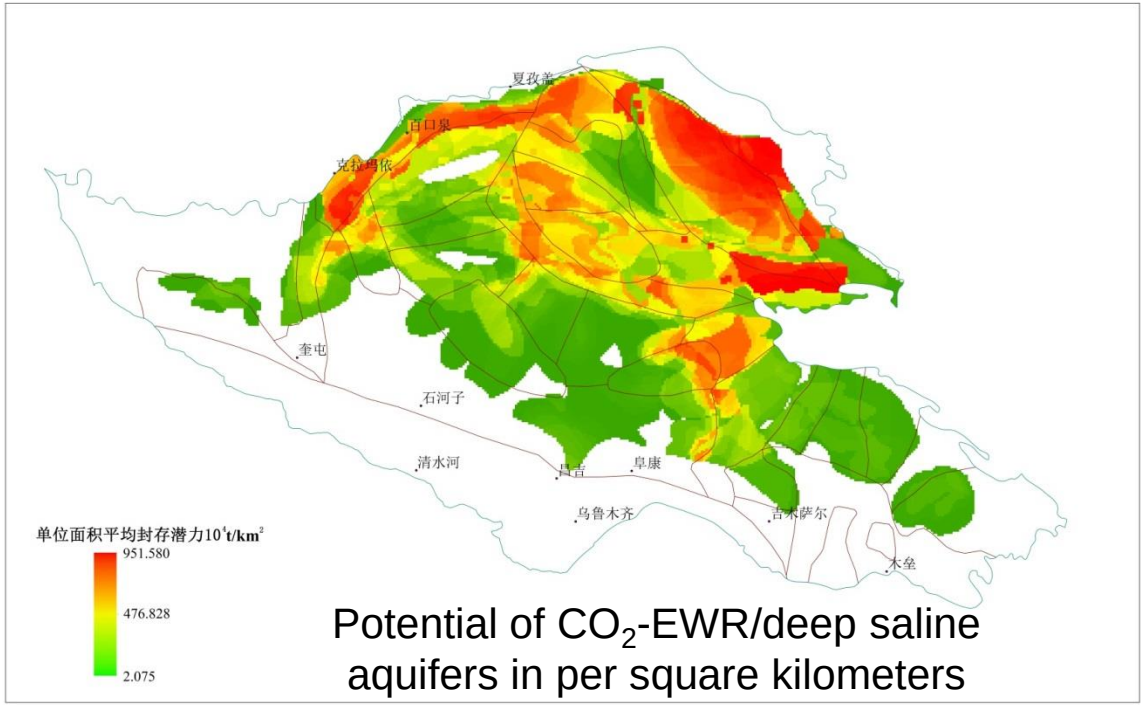
3. Mesoscale potential of CGUS in Junggar Basin



Potential of CO_2-EWR/deep saline aquifers in per square kilometers

USDOE Methodology

$$G_{CO_2} = A \cdot h \cdot \varphi_e \cdot \rho_{CO_2} \cdot E$$

3. Mesoscale potential of CGUS in Junggar Basin

CGUS technologies	Potential (Gt)	Credibility
Enhanced oil recovery, CO_2-EOR	0.15	Effective, Credible
Depleted oil field CO_2 storage	1.35	Effective, Credible
Enhanced gas recovery, CO_2-EGR	0.01	Effective, Credible
Depleted gas field CO_2 storage	0.02	Effective, Credible
Enhanced coal bed methane, CO_2-ECBM	2.28-5.215, 4.02 expected	Theoretical, Less Credible
Unmineable coal seams CO_2 storage	3.41-7.78, 6 expected	Theoretical, Less Credible
CO_2-EWR/deep saline aquifers	4.8-164.09, 96.06 expected	Theoretical, Less Credible

4

SOURCE - STORAGE MATCHING AND EARLY OPPORTUNITIES

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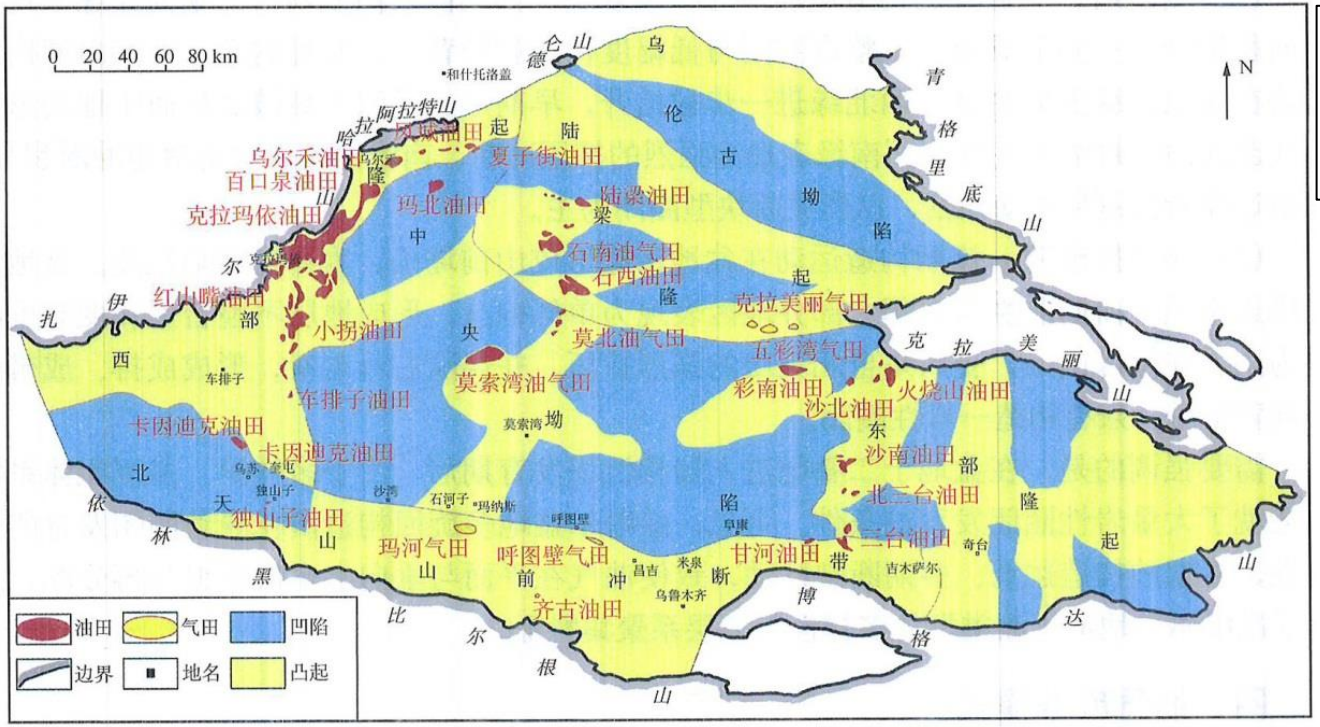
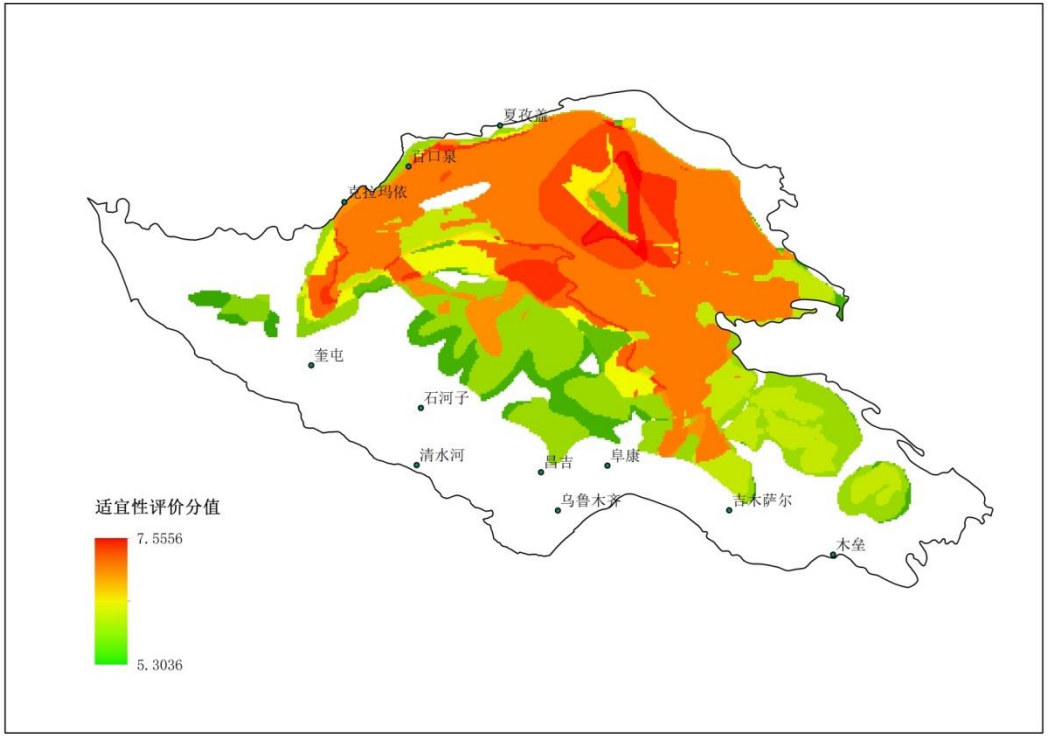
4. Source - storage matching and early opportunities



Targets for CGUS: Existing oil and gas fields

4. Source - storage matching and early opportunities



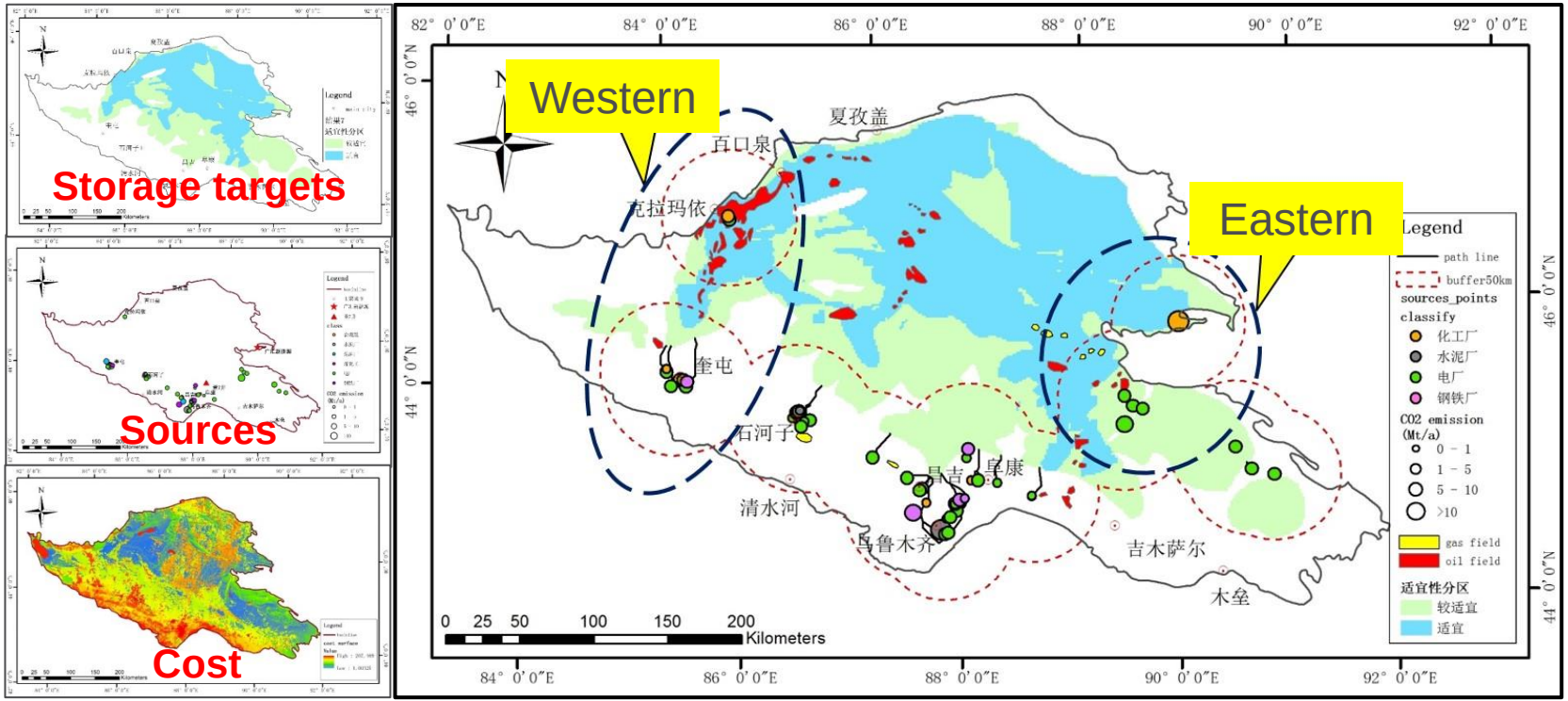
$$P = \sum_{i=1}^{n} P_i A_i (i = 1,2,3.....n)$$

High suitable: 40,581 km^2

Suitable: 34,876 km^2

Targets for CO_2-EWR / deep saline aquifers

4. Source - storage matching and early opportunities



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PREFEASIBILITY STUDY OF CO_2-EWR IN D7 WELL SITE

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5. Prefeasibility study of CO_2-EWR in D7 well site

Google earth

- **D7 well**, an abandoned well of SINOPEC
- Co-funding: Geological survey project of CGS

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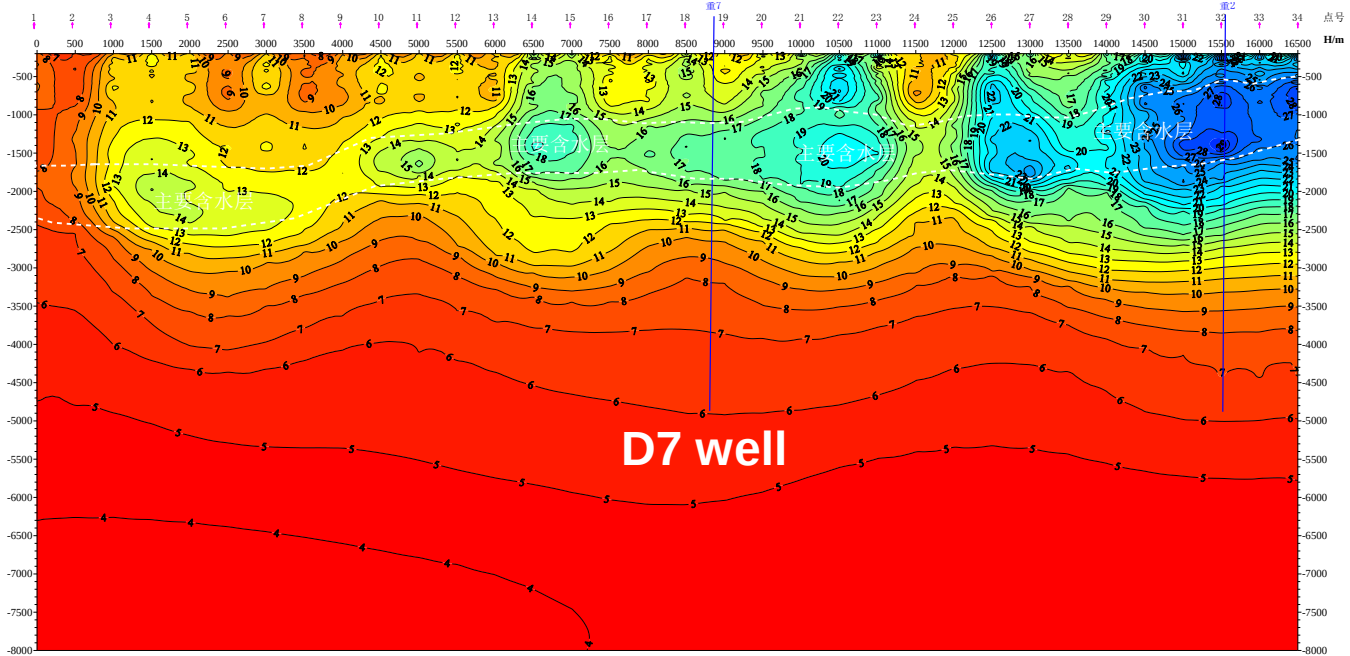
5. Prefeasibility study of CO_2-EWR in D7 well site

Magnetotelluric (MT)



Aquifers

Electrical resistivity

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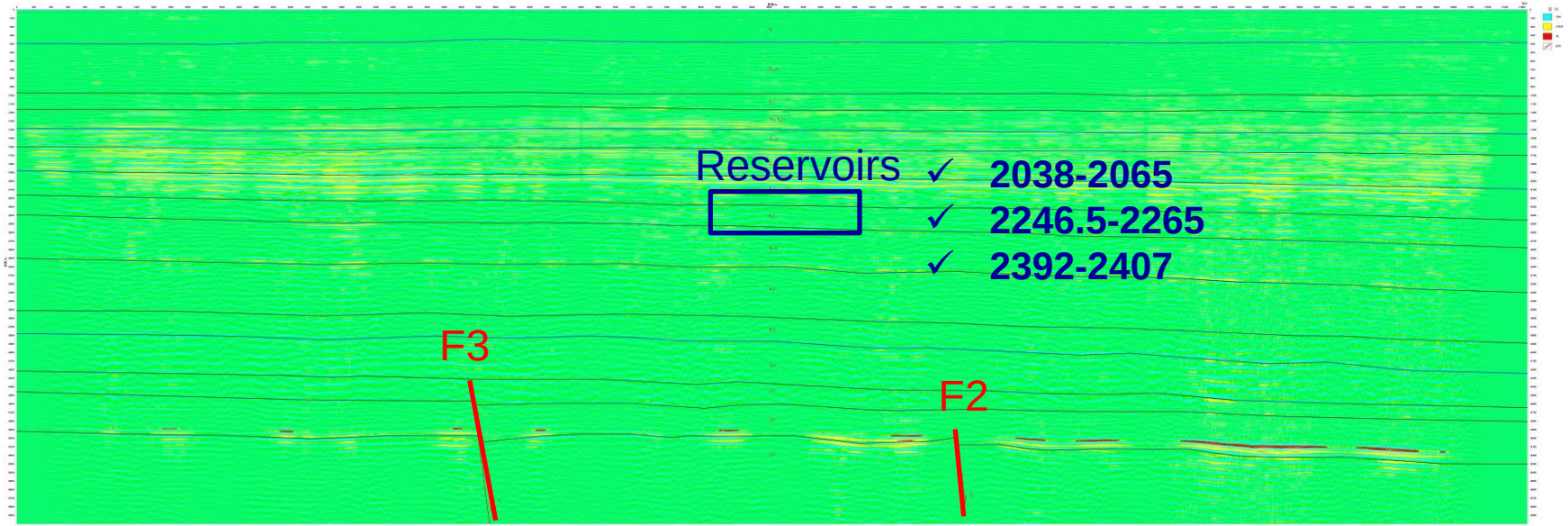
5. Prefeasibility study of CO_2-EWR in D7 well site

2D seismic exploration



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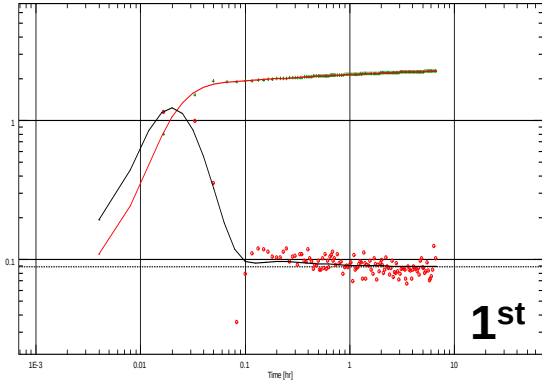
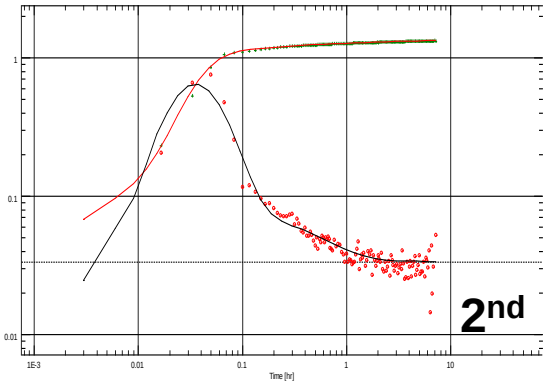
5. Prefeasibility study of CO_2-EWR in D7 well site

Reservoir downhole test



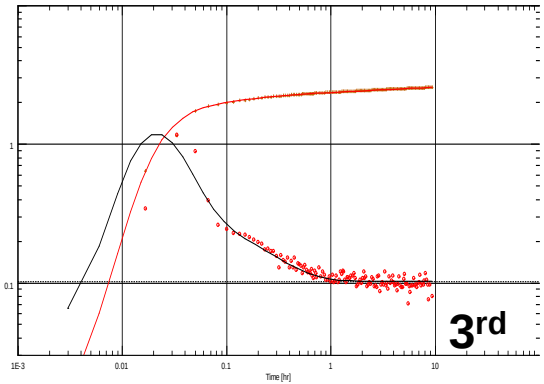
Log-Log plot: p-p@dt=0 and derivative [MPa] vs dt [hr]

Influence radius：55.5m
K: 1.68mD



Log-Log plot: p-p@dt=0 and derivative [MPa] vs dt [hr]

Influence radius：192m
K: 18.9mD



Log-Log plot: p-p@dt=0 and derivative [MPa] vs dt [hr]

Influence radius：138m
K: 7.47mD

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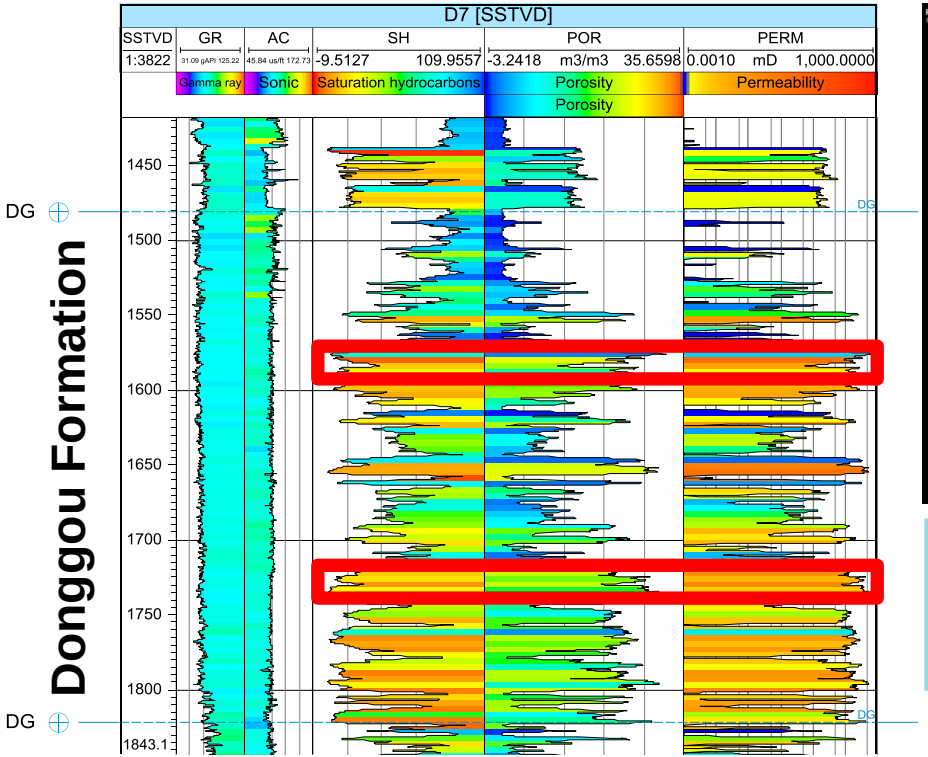
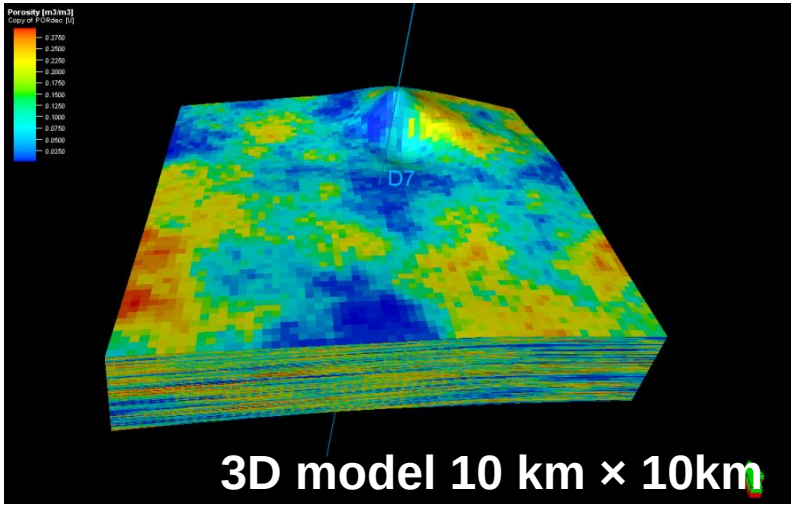
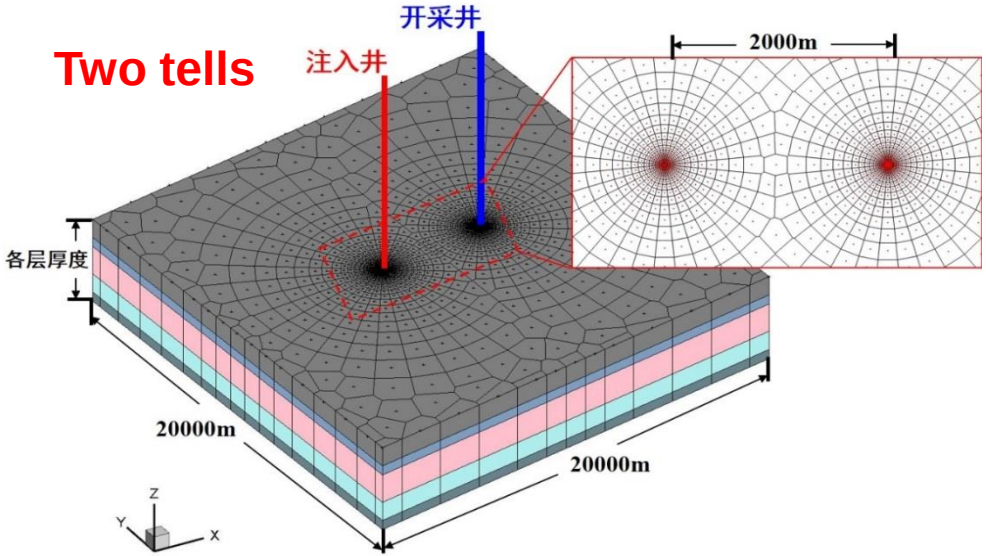
5. Prefeasibility study of CO_2-EWR in D7 well site

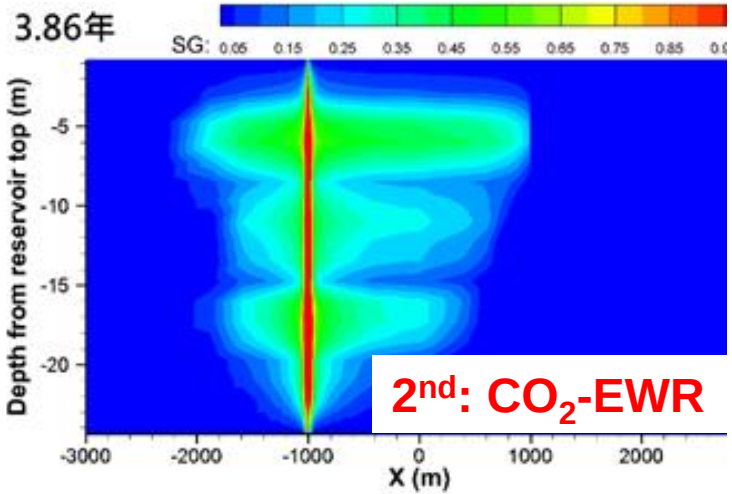




Storage capacity (Mt)	P_{10}	P_{50}	P_{90}
	35.98	71.97	122.94

5. Prefeasibility study of CO_2-EWR in D7 well site





Enhance CO_2 storage amount	65.33%
Enhance water production amount	7.3%

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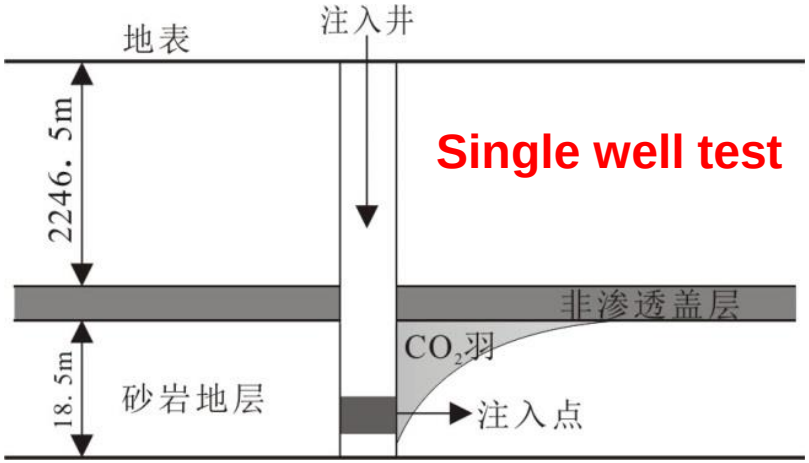
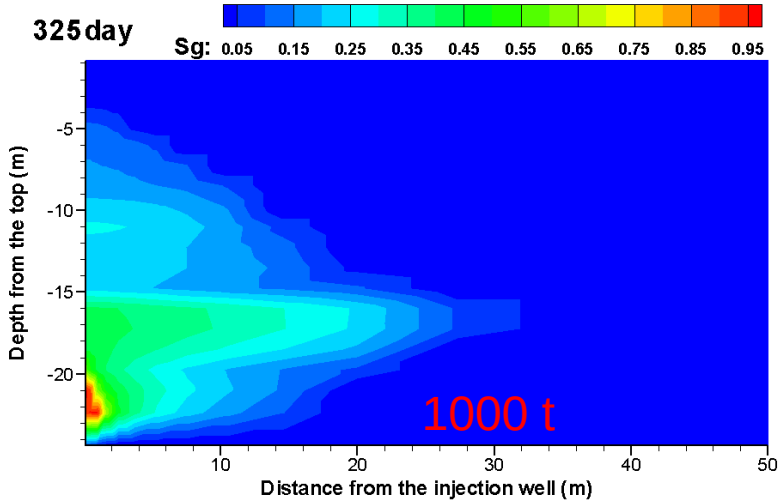
5. Prefeasibility study of CO_2-EWR in D7 well site



Single well test



- **Pull enough formation liquid and test the reservoir permeability; Inject the formation liquid back into reservoirs, test pressure response**
- **Inject CO_2 into the reservoirs, test the pressure response and reservoir injectivity**
- **Pull back the liquid including CO_2 and saline, to test the pressure response and tracers, CO_2 - water reaction**

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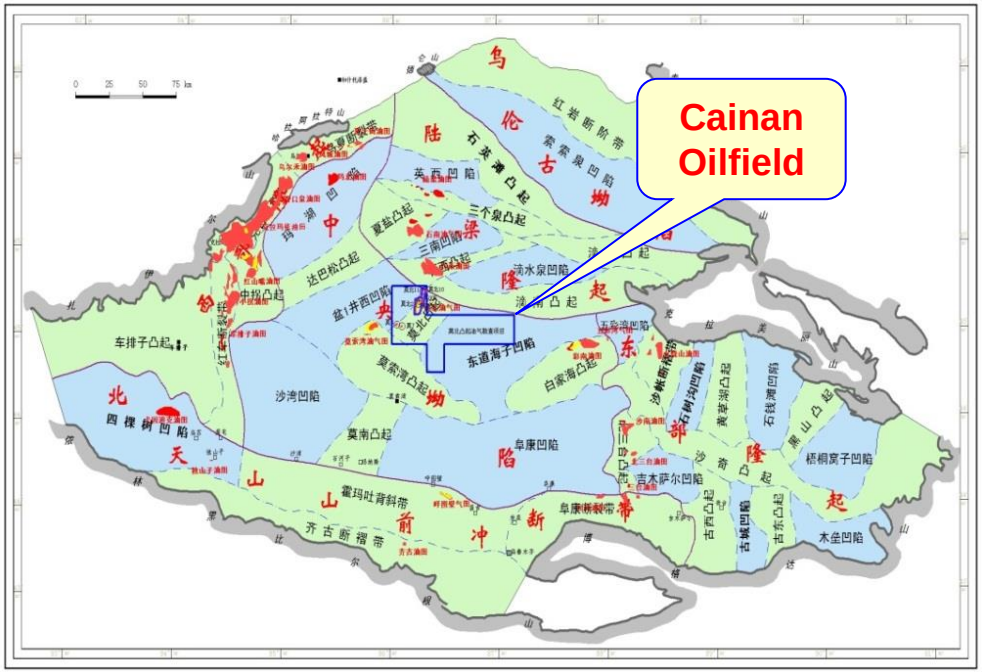
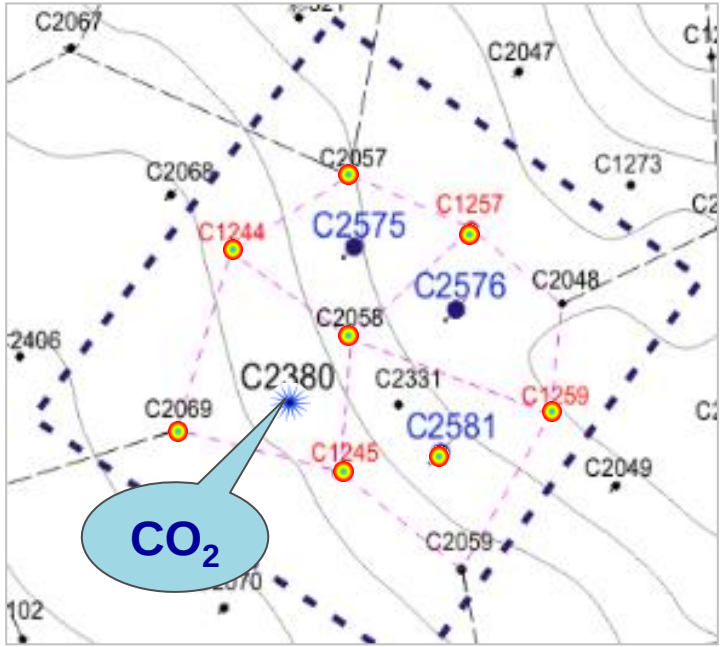


Cainan Oilfield



Multi-wells EWR

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Thank you

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